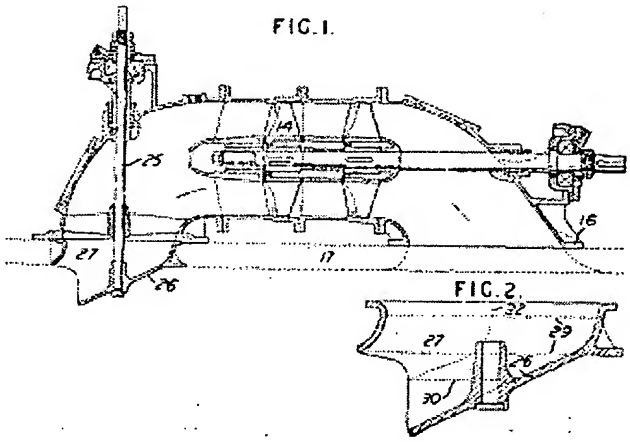
Hydraulic jet propulsion apparatus for water-borne vessels

Patent number:	GB866033
Publication date:	1961-04-26
Inventor:	YEARRON FREDERICK LEONARD
Applicant:	GILL PUMP AND PROPULSION CO LT
Classification:	
- international:	
- european:	B63H11/04B
Application number:	GB19580041376 19581222
Priority number(s):	GB19580041376 19581222

Abstract of **GB866033**

866,033. Propelling and manoeuvring ships. GILL PUMP & PROPULSION CO. Ltd. Dec. 22, 1959 [Dec. 22, 1958], No. 41376/58. Class 114. In a hydraulic jet propulsion apparatus comprising a pump 14 which draws water through an inlet passage at 16 from an opening in the hull 17 and delivers it through a discharge passage to a deflector nozzle 26 which deflects the water in a direction of flow having a substantial component at right angles to an approximately vertical axis 25 about which it is rotatable for steering and man-oeuvring purposes, the deflector nozzle 26 comprises a hollow body containing an uninterrupted and undivided nozzle passage 27 having an inlet end of circular cross- section in planes normal to its axis of rotation 25 and an outlet end which, viewed along the line representing the mean direction of flow there- from; is of approximately elliptical form, the contour of the surface of the nozzle passage from its inlet end over at least the greater part of its length being such that planes normal to the axis of rotation 25 intersect such surface along substantially circular arcs



(complete circles 29 in upper portion and arcs 30 lower down) struck from centres which lie on a smooth curved line 32 extending from the axis of rotation towards the centre of the width of the nozzle outlet. Specifications 503,593, 658,822 and 662,973 are referred to in the Provisional Specification.

PATENT SPECIFICATION

DRAWINGS ATTACHED

Inventor: FREDERICK LEONARD YEARRON

866,033

Date of filing Complete Specification: Dec. 22, 1959.

Application Date: Dec. 22, 1958. *No. 41376/58.*

Complete Specification Published: April 26, 1961.

Index at acceptance:—Class 114, C(22: 23B).

International Classification:—B63h.

COMPLETE SPECIFICATION

Hydraulic Jet Propulsion Apparatus for Water-Borne Vessels

We, THE GILL PUMP AND PROPULSION CO. LIMITED, a Company registered under the Laws of Great Britain, of Parliament Mansions, Abbey Orchard Street, Victoria Street, London, S.W.1, do hereby declare the invention, for which we pray that a patent may be granted to us, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to hydraulic jet propulsion apparatus for water borne vessels of the kind comprising pump apparatus, usually of the axial flow type, within the vessel, which draws water through an inlet passage from an inlet opening in the hull and delivers it through a discharge passage to a nozzle member in the form of a deflector which is rotatable about an approximately vertical axis and serves to deflect the water so that it leaves the deflector nozzle in a direction of flow having a substantial component at right angles to such axis, this direction of discharge being variable by rotation of the deflector nozzle for steering or manoeuvring purposes.

An object of the invention is to provide an improved deflector nozzle for hydraulic propulsion apparatus of the above kind, and improved hydraulic jet propulsion apparatus embodying such a deflector nozzle which, while being simple to manufacture will have certain advantages over previous constructions including that of being less prone to become partially obstructed by debris.

To this end a deflector nozzle for hydraulic jet propulsion apparatus of the kind referred to according to the present invention comprises a hollow body containing an uninterrupted and undivided nozzle passage having an inlet end of circular cross-section in planes normal to its axis of rotation and an outlet end which, viewed along the line representing the mean direction of flow therefrom, is of approximately elliptical form, the contour of the surface of the nozzle passage from its inlet end over at least the greater part of its length being such that planes normal to the axis of rotation of the deflector nozzle intersect such surface along substantially circular arcs struck from centres which lie on a smooth curved line extending from the axis of rotation of the deflector nozzle towards the centre of the width of the nozzle outlet.

By an uninterrupted and undivided nozzle passage is meant one without vanes extending across it and dividing it into a number of separate passages.

In some cases the arrangement may be such that the interior surface of the nozzle passage conforms to the above requirements right up to the extreme edge of its outlet but in other cases the part of the surface of the nozzle passage which lies immediately adjacent to its outlet and on the side thereof remote from the inlet may be flattened as compared with true elliptical contour to provide somewhat increased width to the adjacent part of the outlet.

The invention may be applied to hydraulic jet propulsion apparatus of the kind referred to of various forms, such for example as those shown in the specifications of British Patents Nos. 662,973, 503,593 or 658,822.

The invention may be carried into practice in various ways and a preferred construction will now be described by way of example with reference to the drawing accompanying the Provisional Specification in which

Figure 1 is a sectional side elevation of the complete hydraulic propulsion unit, the section being taken in a plane containing the axis of rotation of the pump and the axis of the shaft supporting the deflector nozzle,

Figure 2 is an enlarged cross-sectional view of the deflector nozzle, the cross-section being taken in the same plane as in Figure 1,

Figure 3 is a view along the mean line of discharge from the deflector nozzle indicating

the shape of the outlet of the nozzle, and

Figure 4 is a view looking up from below of the deflector nozzle on the same scale as Figures 2 and 3 with some of the intersection lines between planes normal to the axis of the shaft and the surface of the nozzle passage, and the centres from which these arcuate intersection lines are struck indicated respectively in dotted lines and by small crosses.

The apparatus comprises a two-stage axial flow pump 11 having a two part tubular casing 12 each part of which is provided with a set of approximately radial guide vanes 13 extending inwards from the wall of the casing and supporting a bearing at their inner ends, and an impeller assembly 14 comprising a shaft supported in the bearings and carrying two impellers, one of which lies between the two sets of guide vanes 13 while the other lies on the upstream side of the upstream set of guide vanes which set thus serve as the guide vanes between the two impeller stages. The inlet end of the tubular pump casing 12 is secured to and communicates with an inlet passage in the form of a bend 15 formed so that its inlet end 16 can be secured to the hull 17 of a vessel through which it opens while its other end 18, which is secured to the inlet end of the pump casing 12, lies in an approximately vertical plane so that the pump casing extends substantially horizontally. The shaft 19 carrying the impeller assemblies passes out through a gland 21 in this bend 15 and is provided with means by which it can be driven from a suitable prime mover.

The opposite end of the tubular pump casing 12 communicates with a right-angled bend 22 of small radius of curvature constituting the discharge passage of the pump and having an external flange 23 at its outlet end, i.e. the end remote from the pump, by which it can be secured to the hull 17 of the vessel so that it opens through that hull. The outlet end of the discharge passage is thus of approximately circular cross-section in horizontal planes, assuming, as would normally be the case, that the inlet and discharge passages open through the bottom of the ship's hull.

Arranged within the discharge passage coaxially with its outlet and extending upwards through a gland 24 in the wall of the bend 22 is a vertical shaft 25 the lower end of which carries a deflector nozzle 26 according to the invention. This deflector nozzle 26 comprises a hollow body without vanes dividing it into a number of separate passages and constituting an undivided and uninterrupted nozzle passage 27, the upper end of which is of circular cross section in planes normal to the axis of the shaft 25 by which it is supported and of approximately the same diameter as the lower end of the discharge passage formed by the bend 22. The mean direction of the nozzle passage outlet, that is to say the mean direction of flow of water from that outlet, has a substantial component in a direction at right angles to the axis of said shaft, that is to say in a horizontal direction. For example the mean angle of discharge relatively to the axis of the shaft might be between 15° and 35° from the horizontal.

The form of the nozzle passage 27 constituted by the deflector nozzle 26 is such that planes normal to the axis of the shaft 25 will intersect the surface of the nozzle passage 27 along substantially circular arcs which, as regards the planes which are above the upper edge 28 of the outlet of the nozzle passage, will be complete circles 29 (Figures 2 and 4) while in lower planes they will be circular arcs 30 which diminish in arcuate length from the upper to the lower planes, the centres 31 from which all such arcs are struck lying on a smooth curved line 32 in a vertical plane extending from the axis of the shaft 25 towards and through the outlet of the nozzle passage 27. This outlet will therefore, when viewed along a line representing the mean direction of discharge therefrom, have an elliptical contour 33 (Figure 3). The lower edge 34 of the nozzle 26 forms one side of the ellipse. In a modification however, the contour of the lower edge portion of the outlet passage may be somewhat modified so as to be somewhat flattened as compared with the true ellipse as shown at 35 in Figure 3.

Of course the jet can be discharged from the nozzle either below or above the surface of the water.

WHAT WE CLAIM IS:—

1. A deflector nozzle for hydraulic jet propulsion apparatus of the kind referred to comprising a hollow body containing an uninterrupted and undivided nozzle passage having an inlet end of circular cross-section in planes normal to its axis of rotation and an outlet end which, viewed along the line representing the mean direction of flow therefrom, is of approximately elliptical form, the contour of the surface of the nozzle passage from its inlet end over at least the greater part of its length being such that planes normal to the axis of rotation of the deflector nozzle intersect such surface along substantially circular arcs struck from centres which lie on a smooth curved line extending from the axis of rotation of the deflector nozzle towards the centre of the width of the nozzle outlet.

2. A deflector nozzle as claimed in Claim 1 in which the interior surface of the nozzle passage conforms to the requirements stated in Claim 1 not merely through the greater part of its length but right up to the extreme edge of its outlet.

3. A deflector nozzle as claimed in Claim 1 in which the part of the surface of the nozzle passage which lies immediately adjacent to its outlet and on the side remote

from its inle[redacted]attened to provide a somewhat increased width at this part of the outlet.

4. A deflector nozzle for hydraulic propulsion apparatus constructed and arranged as herein specifically described with reference to Figures 2, 3 and 4 of the drawing accompanying the Provisional Specification.

5. Hydraulic propulsion apparatus for water vessels including a deflector nozzle as claimed in any of th[redacted]receding claims.

6. Hydraulic propulsion apparatus as claimed in Claim 5 in which the inlet end of the deflector nozzle is disposed coaxially with and opening out from a discharge passage connected to deliver water from a pump in the vessel.

KILBURN & STRODE,
Agents for the Applicants.

PROVISIONAL SPECIFICATION

Hydraulic Jet Propulsion Apparatus for Water-Borne Vessels

We, THE GILL PUMP AND PROPULSION CO. LIMITED, a Company registered under the Laws of Great Britain, of Parliament Mansions, Abbey Orchard Street, Victoria Street, London, S.W.1, do hereby declare this invention to be described in and by the following statement: —

This invention relates to hydraulic jet propulsion apparatus for water borne vessels of the kind comprising pump apparatus, usually of the axial flow type, within the vessel, which draws water through an inlet passage from an inlet opening in the hull and delivers it through a discharge passage to a nozzle member in the form of a deflector which is rotatable about approximately the axis of the outlet end of the discharge passage, has an inlet end of approximately circular cross-section in planes normal to that axis and into which the discharge passage opens and serves to deflect the water so that it leaves the deflector nozzle in a direction of flow having a substantial component at right angles to such axis, this direction of discharge being variable by rotation of the deflector nozzle for steering or manoeuvring purposes.

An object of the invention is to provide an improved deflector nozzle for hydraulic propulsion apparatus of the above kind, and improved hydraulic jet propulsion apparatus embodying such a deflector nozzle which, while being simple to manufacture will have certain advantages over previous constructions including that of being less prone to become partially obstructed by debris.

To this end a deflector nozzle for hydraulic jet propulsion apparatus of the kind referred to according to the present invention comprises a hollow body containing an uninterrupted and undivided nozzle passage having an inlet end of circular cross-section in planes normal to its axis of rotation and disposed co-axially with and opening out of the discharge passage, and an outlet end which, viewed along the line representing the mean direction of flow therefrom, is of approximately elliptical form, the contour of the surface of the nozzle passage from its inlet end over at least the greater part of its length being such that planes normal to the axis of rotation of the deflector nozzle intersect such surface along substantially circular arcs struck from centres which lie on a smooth curved line extending from the axis of rotation of the deflector nozzle towards the centre of the width of the nozzle outlet.

By an uninterrupted and undivided nozzle passage is meant one without vanes extending across it and dividing it into a number of separate passages.

In some cases the arrangement may be such that the interior surface of the nozzle passage conforms to the above requirements right up to the extreme edge of its outlet but in other cases the part of the surface of the nozzle passage which lies immediately adjacent to its outlet and on the side thereof remote from the inlet may be flattened as compared with true elliptical contour to provide somewhat increased width to the adjacent part of the outlet.

The invention may be applied to hydraulic jet propulsion apparatus of the kind referred to of various forms, such for example as that shown in the specification of British Patent Specification No. 662,973 or No. 503,593 or No. 658,822, and the following is a description by way of example of one construction according to the invention as applied to hydraulic jet propulsion apparatus of the general kind described in British Patent Specification No. 658,822 but modified to embody a two-stage axial flow pump.

The apparatus comprises a two-stage axial flow pump having a two part tubular casing each part of which is provided with a set of approximately radial guide vanes extending inwards from the wall of the casing and supporting a bearing at their inner ends, and an impeller assembly comprising a shaft supported in the bearings and carrying two impellers, one of which lies between the two sets of guide vanes while the other lies on the upstream side of one set of guide vanes, which set thus serve as the guide vanes between the two impeller stages. The inlet end of the tubular pump casing is secured to and communicates with an inlet passage in the form of a bend formed so that its inlet

end can be secured to the hull of a vessel through which it thus opens while its other end, which is secured to the inlet end of the pump casing, lies in an approximately vertical plane so that the pump casing extends substantially horizontally. The shaft constituting part of the impeller assembly passes out through a gland in this bend and is provided with means by which it can be driven from a suitable prime mover.

The opposite end of the tubular pump casing communicates with a right-angled bend of small radius of curvature constituting the discharge passage of the pump and having an external flange at its outlet end, i.e. the end remote from the pump, by which it can be secured to the hull of the vessel so that it opens through that hull. The outlet end of the discharge passage is thus of approximately circular cross-section in horizontal planes, assuming, as would normally be the case, that the inlet and discharge passages open through the bottom of the ships hull.

Arranged within the discharge passage coaxially with its outlet and extending upwards through a gland in the wall of such discharge passage is a vertical shaft the lower end of which carries a deflector nozzle according to the invention. This deflector nozzle comprises a hollow body constituting an undivided and uninterrupted nozzle passage, the upper end of which is of circular cross section in planes normal to the axis of the shaft by which it is supported and of approximately the same diameter as the lower end of the discharge passage while the mean direction of its outlet, that is to say the mean direction of flow of water from that outlet, has a substantial component in a direction at right angles to the axis of said shaft, that is to say in a horizontal direction. For example the mean angle of discharge relatively to the axis of the shaft might be between 15° and 35° from the horizontal.

The form of the nozzle passage constituted by the deflector nozzle is such that planes normal to the axis of the shaft supporting the deflector nozzle will intersect the surface of the nozzle passage along substantially circular arcs which, as regards the planes which are above the upper edge of the outlet of the nozzle passage, will be complete circles while in lower planes they will be circular arcs which diminish in arcuate length from the upper to the lower planes, the centres from which all such arcs are struck lying on a smooth curved line extending from the axis of the shaft supporting the deflector nozzle towards and through the outlet of the nozzle passage. This outlet will therefore, when viewed along a line representing the mean direction of discharge therefrom, have an eliptical contour. In a modification however, the contour of the lower edge portion of the outlet passage may be somewhat modified so as to be somewhat flattened as compared with the true elipse.

A construction according to the invention is shown by way of example in the accompanying drawings in which

Figure 1 is a sectional side elevation of the complete hydraulic propulsion unit, the section being taken in a plane containing the axis of rotation of the pump and the axis of the shaft supporting the deflector nozzle.

Figure 2 is an enlarged cross-sectional view of the deflector nozzle, the cross section being taken in the same plane as in Figure 1.

Figure 3 is a view along the mean line of discharge from the deflector nozzle indicating the shape of the outlet of the nozzle in full line, the somewhat modified shape referred to above being indicated by chain lines, and

Figure 4 is a view looking up from below of the deflector nozzle on the same scale as Figures 2 and 3 with some of the intersection lines between planes normal to the axis of the shaft and the surface of the nozzle passage, and the centres from which these arcuate intersection lines are struck indicated respectively in dotted line and by small crosses.

KILBURN & STRODE,
Agents for the Applicants.

Leamington Spa: Printed for Her Majesty's Stationery Office, by the Courier Press.—1961.
Published by The Patent Office, 25, Southampton Buildings, London, W.C.2, from which copies may be obtained.

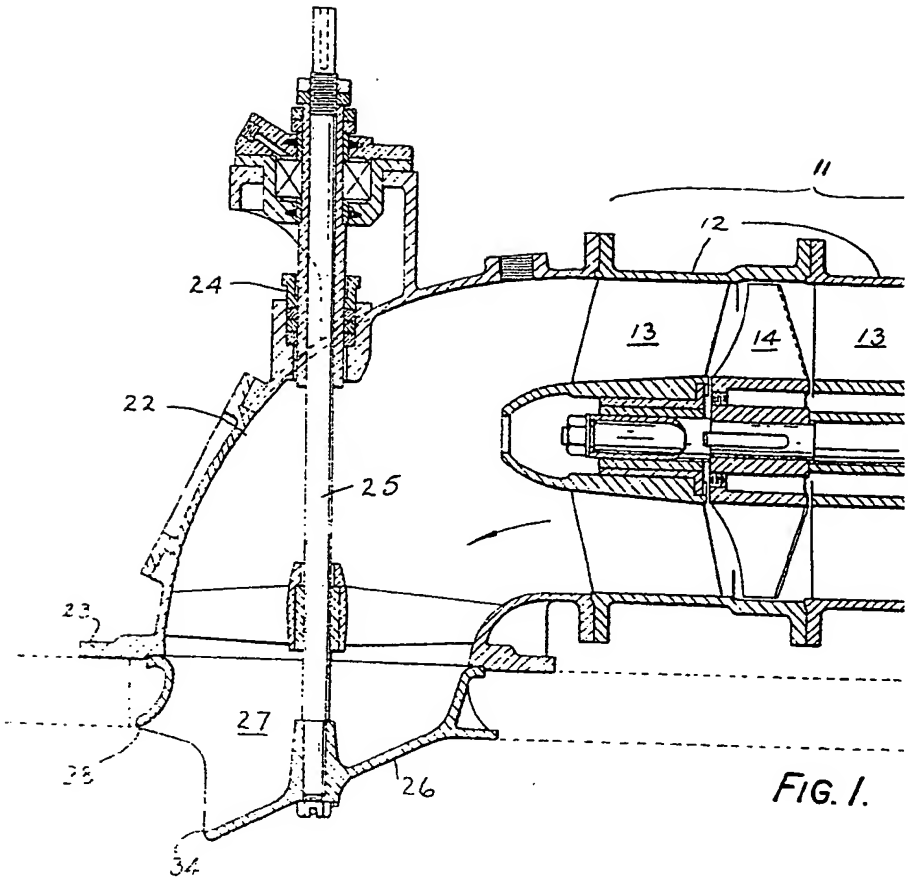


FIG. 1.

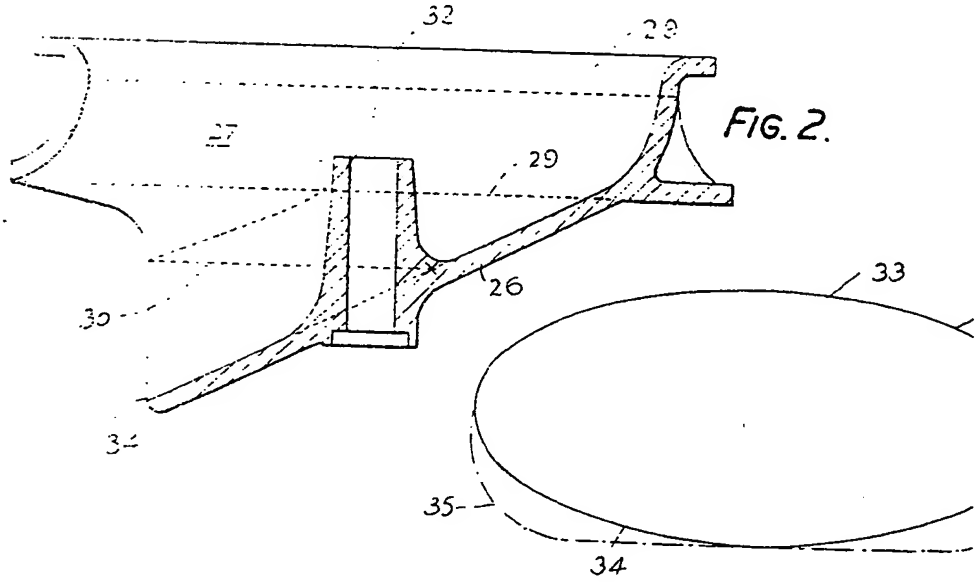


FIG. 2.

866,033 PROVISIONAL SPECIFICATION

1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

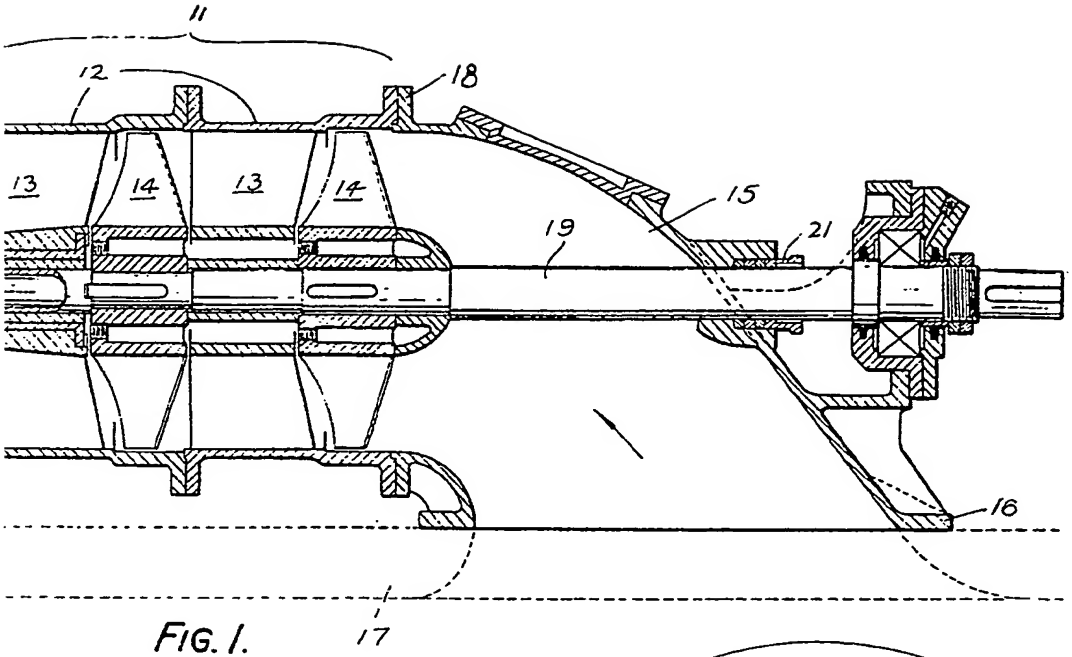


FIG. 1.

FIG. 2.

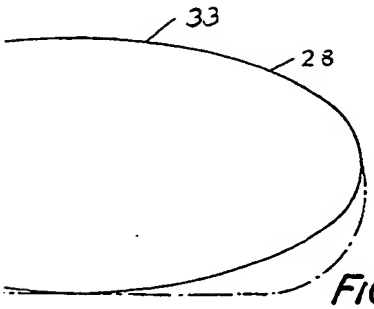


FIG. 3.

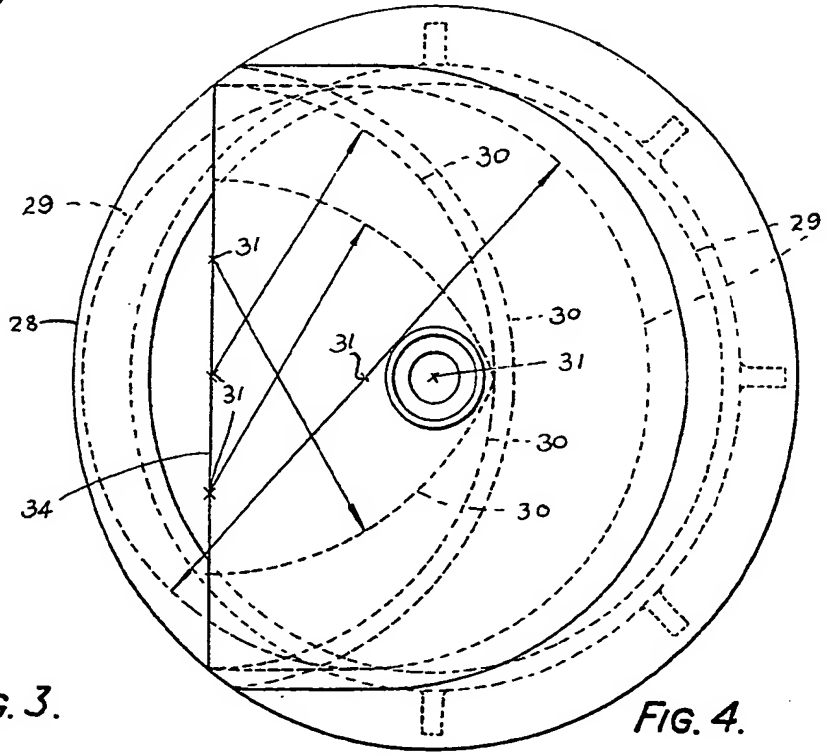


FIG. 4.

866,033 PROVISIONAL SPECIFICATION
1 SHEET

This drawing is a reproduction of the Original on a reduced scale.

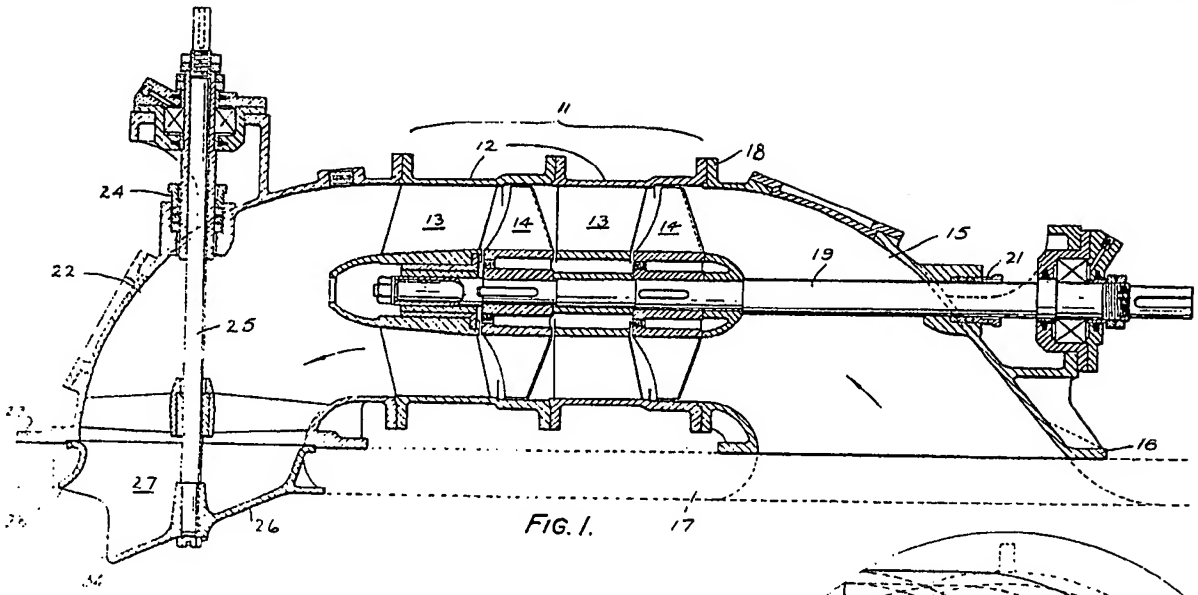


FIG. 1.

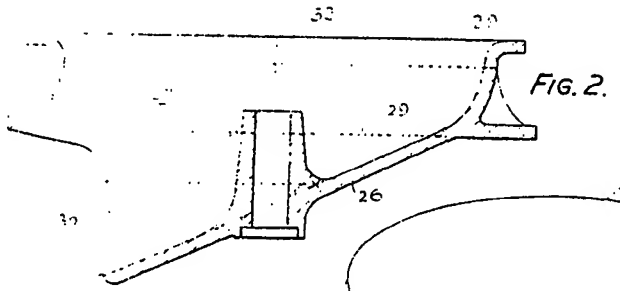


FIG. 2.

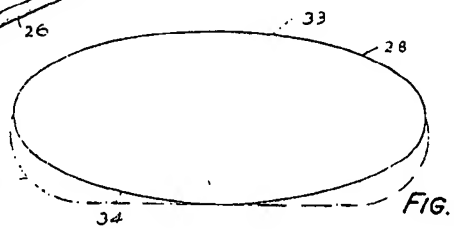


FIG. 3.

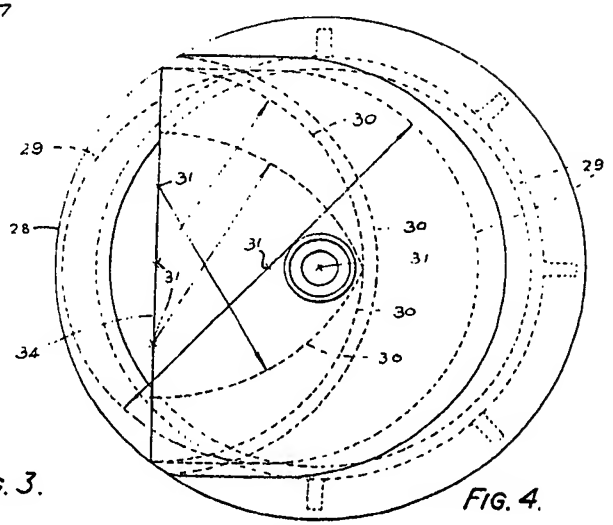


FIG. 4.